METHAMPHETAMINE USE IN THE WORKPLACE

Report to the California Department of Alcohol and Drug Programs

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Executive Summary

This report provides a brief summary of current knowledge of prevalence of workplace use of methamphetamine/amphetamine (MA). It examines data sources that are readily available and appropriate for determining MA prevalence in the workplace, describes prevalence using recent indicators, provides brief descriptions of MA prevalence and historical results of workplace MA-related substance use, and gives a rough estimate of potential cost of California workplace MA use.

Context

MA is central nervous system stimulant, with immediate effects that can include increased attention and activity and improved performance, characteristics that have encouraged its use in work situations. However, the typical high dose, chronic use can result in severe effects including insomnia, anxiety, irritability, paranoia, hallucinations, confusion, cognitive impairment.

Increasing MA use is having a widespread impact. For example, a recent survey of county law enforcement agencies in 45 states indicates that 58% identify MA as their major drug problem. Treatment admissions for MA have experienced a five-fold increase from 1992-2002 in California and nationwide. Since costs of workplace drug use in general are high, these increases in MA use are stimulating examination of workplace MA use to document its prevalence.

Data Sources

In reviewing workplace MA prevalence, the report has utilized diverse sources; these sources differ on a number of dimensions that are important to consider when interpreting results. These dimensions include, e.g. workplace vs. workforce focus, focus on general populations or MA user groups, the method of data collection (e.g. self-report or drug screening test), which drugs were included (e.g. MA or amphetamine-type stimulants or stimulants in general), recentness of use (e.g. within past 3 days or past month), and whether employees' or participants' provision of information is voluntary or mandatory. Primary data sources for prevalence estimates presented in this report include an on-going summary of drug testing results from a large laboratory covering a range of occupations and the National Survey on Drug Use and Health that provides data on workforce drug use. Other sources include federal agency reports and research studies.

Prevalence of MA in Workplace/Workforce

Results of 7.2 million workplace drug tests nationwide showed the following MA prevalence rates: 0.31% in 2004 for the segment of the workforce with federally mandated drug testing programs (for safety-sensitive work) with gradual small increases from a level of 0.25% in 1998; and 0.52% in 2004 for the general workforce, double the 1997 rate. National Survey on Drug Use and Health results showed a slight increase in past month MA use from about 0.2% in 1999 to almost 0.3% in 2003 among employed adults.

Using the above studies as a basis plus additional information suggesting that California typically shows higher MA prevalence than national averages, a rough conservative estimate of numbers of MA-using California workers was calculated at 147,000 which could produce costs to business of about $6.9 billion.

Other studies give a range of estimates, depending on types of data and study characteristics, e.g. 0.05% in 2002 for drug test results among transit workers; 1.4% in 2004 among workers in an Arkansas county; 15-28% self-reported MA use among truckers, 58%-97% self-reported MA use among pilots on military deployment.

Recommendations

The increasing trends of workplace MA use and potential costs substantiate a need to evaluate workplace drug-related programs for their relevance to MA users. In addition, further in-depth studies are suggested to examine California workplace MA use in more detail, e.g. through examination of a broader range of occupation- or employer-specific data sources and reports, by surveying California employers for summaries of workplace drug-testing results, through further in-depth analysis of National Survey on Drug Use and Health data, and by specializing a cost analysis to California employment characteristics.

Introduction

Workplace substance abuse was estimated to have cost U.S. employers $160.7 billion in year 2000 through lost productivity, absenteeism and turnover, and accidents and health care costs (ONDCP, 2001). Historically, methamphetamine/amphetamine (MA) has accounted for a very small proportion of workplace substance use and has typically not been described in most studies. But for the past decade, MA use has been spreading across the U.S. from the historically higher-use western states through central and southern regions. Most indicators of drug prevalence show increases in MA use. For example, nationwide for 2004, 40% of state and local law enforcement agencies cited MA as their primary drug threat (NDIC, 2005). Over the period 1992-2002, California experienced a more than five-fold increase in numbers of MA treatment admissions (Brecht & Greenwell, 2004). These increases have generated questions about whether MA use in the workplace is also increasing and what is the current prevalence of MA use by the workforce and in the workplace. Information about MA workplace prevalence can provide a basis for policy development for specializing or expanding workplace prevention and intervention programs to counter the growing MA epidemic.

Purpose

The purpose of this report is to summarize current knowledge of prevalence of workplace MA use. More specifically, we examine data sources that are readily available and appropriate for determining MA prevalence in the workplace. We describe prevalence in the workplace using recent indicators, which provide complementary perspectives. In addition, we provide context for these results through brief descriptions of MA prevalence from a range of occupations and historical results of workplace MA-related substance use. Because there is little current information readily available on MA use in the work place, we consider this a preliminary report and make recommendations for further in-depth study.

Organization of Report

The first section of the report provides a context for considering prevalence of MA use in the workplace. This section contains a brief summary of MA history, its effects, and current general prevalence as relevant to the current MA epidemic and its use in the workplace. The section also addresses the question “why look at workplace drug (and MA) use?” The next section summarizes major types and sources of data available for determining MA prevalence in the workplace. The third section summarizes recent MA workplace prevalence and trends from major data sources. The final section reviews major findings and provides recommendations. (See Technical Note 1 for more detail on MA terminology).

Context

History of Methamphetamine

Ephedrine (a form of amphetamine) was synthesized in the late 1800s by German chemists and marketed in the 1920s in bronchial inhalers. (See Hunt et al. [2005] for more detailed history.) Methamphetamine was developed by the Japanese in 1919. In the 1930s and 1940s, amphetamines and methamphetamine (under a variety of brand names) were prescribed for disorders such as

narcolepsy, depression, Parkinsons, and attention deficit disorder and also were used for weight control and to stay awake. Amphetamines were used by the military, including U.S., Japanese, British, and German, to combat fatigue in World War II, and by U.S. pilots in Vietnam and more recent conflicts (Emonson & Vanderbeek, 1995; Kenagy et al., 2004; other sources reported in NSAWC, 2004).

A post-WWII epidemic of MA use in Japan prompted the 1951 Stimulant Control Law, making non-prescription use of MA illegal (Tamura, 1989). Use increased substantially in the U.S. in the 1960s, and MA was labeled a schedule II drug in 1970 (Hunt et al., 2005). MA use declined in the U.S. during the 1970s and 1980s, and then began its climb into the current epidemic.

Effects of MA

MA is a central nervous system stimulant, affecting neurotransmitter systems including dopamine (Logan, 2002; NIDA, 2002, 2005). Immediate effects include increased concentration, more focused attention, and increased alertness and activity, characteristics which have encouraged its use in work situations (NSAWC, 2004). Studies have documented performance-enhancing effects of low oral doses of MA to counter fatigue, under controlled conditions. For example, MA can attenuate many of the disruptions in performance and mood produced by shift changes (Hart et al., 2003) and can sustain helicopter pilot performance or improve aviator fatigue ratings and alertness measures in flight simulators during periods of sleep deprivation (Caldwell, 2001; Caldwell et al., 1995). The military provides recommendations/guidelines on low dose MA usage to combat fatigue and enhance attention and performance (NSAWC, 2004). However, short-term low dosage is not a typical pattern of use.

Immediate effects from low dosages can also include restlessness, dizziness, insomnia, and confusion (Logan, 2002). With higher-dose, chronic, high intensity usage, MA can result in a variety of more severe effects, including intense euphoria, insomnia, talkativeness, sexual arousal, anxiety, irritability, paranoia, hallucinations, confusion, malnutrition, and longer-term cognitive impairment, which can have implications for reduced user health and functioning and, in turn, reduced workplace productivity (Logan, 2002; London et al., 2004; Simon et al., 2004).

MA Prevalence

National surveys have shown some increases in MA prevalence in the general population over the past decade. The prevalence of any MA use over the lifetime, as self-reported by participants (age 12 and older) in the National Survey on Drug Use and Health (NSDUH), has risen from less than 2% in 1994 to more than 5% in 2003 (Hunt et al., 2005). In some subpopulations and some geographic areas, prevalence is much higher. For example, for 2003 the prevalence of current MA use among arrestees tested in the Arrestee Drug Abuse Monitoring system indicated MA positive rates of more than 20% in 12 of 39 sites for males and 9 of 25 sites for females with five of those above 40% (Zhang, 2003).

Nationwide for 2004, 40% of state and local law enforcement agencies cited MA as their primary drug threat; in the western region (CA, NV, ID, WA, OR), 92% cited MA as primary drug (NDIC, 2005). Only the northeastern region had levels substantially lower than the national figure. A recent survey of 500 county law enforcement agencies in 45 states showed that 58% said that MA was

their major drug problem (Kyle & Hansell, 2005). Over the period 1992-2002, admissions for treatment of MA use increased substantially in California, with a more than five-fold increase in numbers of MA admissions (Brecht & Greenwell, 2004). These figures reflect a similar five-fold nationwide increase in rates of treatment for MA: from 10 per 100,000 population in 1992 to 52 in 2002 (SAMHSA, 2004b). In 1992, MA admissions were less than 10% of total substance abuse treatment admissions for all states. By 2002, in 16 states MA admissions represented 10% or more of total treatment admissions (ranging from 10% to 35%) (Hunt et al., 2005).

Why Look at Workplace Substance Use?

The cost of substance use to U.S. businesses was projected to be $160.7 billion in 2000, about 2/3 of which was due to productivity losses (ONDCP, 2001). A Center for Substance Abuse Prevention (CSAP) fact sheet (1998) summarized others costs, e.g.: substance abusers are 3.6 times more likely to be involved in workplace accidents, five times more likely to file a workers' compensation claim, and three times more likely to use medical benefits. In addition, illicit drug users have higher absence and turnover rates than other employees (SAMHSA, 2002a; Zhang et al., 1999). A recent Arkansas study estimated that each MA-using employee was costing his/her employer almost $50,000 in lost productivity and increased absenteeism, turnover, healthcare costs (including drug treatment), and theft (CBER, 2004; see below for more detail on this study). Concerns over such costs have encouraged initiatives to prevent and reduce substance use by workers, which may be decreasing the costs (TATC Consulting, 2003; Wickizer et al., 2004).

Rates of workplace MA use are typically substantially lower than for alcohol, marijuana, or cocaine; nevertheless, MA use has been increasing and even low rates are estimated to result in considerable costs to business. Theses costs couple with other social costs (e.g. through law enforcement, child welfare, health) make continued attention to MA an imperative.

Data for Determining Prevalence

Types of Data

We have examined data from a variety of sources for this report, in order to provide the broadest possible overview of methamphetamine use in the workplace. However, care must be taken in comparing prevalence rates across sources because these sources differ along several dimensions which may affect prevalence magnitude, including workplace vs. workforce focus, focus on general populations or MA user groups, the method of data collection (e.g. self-report or drug screening test), which drugs were included (e.g. MA or amphetamine-type substances [ATS] or stimulants in general), recentness of use (e.g. within past 3 days or past month), and whether employees' or participants' provision of information is voluntary or mandatory. We discuss below major classifications within these dimensions and possible differences in magnitude.

Workplace vs. Workforce

We include information on both workplace and workforce MA use, in order to provide a more comprehensive picture. These foci give complementary, but not identical information. Drug screening results from employment contexts provide a perspective of drug use in the workplace.

Self-report data can also reflect the workplace, if questions ask specifically about use of MA for work-related reasons and in workplace venues. Alternatively, some data sources allow an inference about drug use by the work force, since they collect data on employment status and on drug use, typically asking about recent use (e.g. during past month) but not specifically linking the timing of drug use to working hours.

General Population vs. MA User Groups

A primary perspective for workplace drug prevalence is through rates of use within a specified general population that includes both users and non-users (typically presented as a percentage calculated from the ratio of number of drug users to the number in the total population). Another perspective is to focus on subgroups of drug users, and describe the percentage of them that report use of the drug in the workplace or for work reasons. These two perspectives are not directly comparable, but give complementary information for understanding the problem of workplace drug use.

Data Collection Method

In general population or workplace surveys, self-report data may underestimate substance use prevalence, thus producing lower prevalence rates than would be found by drug screen testing (Richter & Johnson., 2001). Data collection methods may include procedures to optimize self-report validity for sensitive questions; for example, the National Survey on Drug Use and Health (NSDUH, formerly known as the National Household Survey on Drug Abuse) uses computer-assisted self-interviewing for most questions. Such data, when consistent in their collection methodology, can provide a good basis for measuring trends; however, the potential for underestimating should be considered when interpreting absolute magnitude.

Drug screening tests can provide acceptably accurate measures, most commonly from urine or blood for recent (e.g. for urine tests, approximately three days) use of MA-related substances. However, test accuracy may also vary due to a variety of conditions, and guidelines are available to maximize validity (SAMHSA, 2004a).

Which Drugs Are Identified

The specific identification of MA in studies relating to workplace drug use has increased in recent years, because of the increasing prevalence of MA. In many earlier studies, stimulants were considered as a broader category; while usually separated from cocaine and crack, this category could include a wide range of prescription and non-prescription stimulants. More recently, some studies focus on “amphetamine-type stimulants” (ATS), covering amphetamine, methamphetamine, related stimulants such as Dexedrine or dextroamphetamine, and sometimes Ecstasy. Some studies differentiate methamphetamine from other amphetamines; others do not differentiate and may label the result as either methamphetamine (including other amphetamines) or amphetamines (including methamphetamine). At least for the past decade, the vast majority of MA or ATS use in many contexts is methamphetamine (see Technical Note 1).

Recentness of Drug Use

Self- report studies differ in the time frame used for reporting drug use; commonly used metrics include any use during past month, past year, or ever in the respondent's lifetime. Prevalence rates increase with an increasing time frame. Urine tests detect only very recent use.

Voluntary vs. Mandatory Reporting

Response rates can differ widely depending whether response is part of a mandated or employer-required drug testing program (see below for more detail on such programs) or whether study participation is completely voluntary. Many studies with voluntary response have very low participation rates, so results may not be generalizable to the population addressed; typically we would expect results to be an underestimate of drug use prevalence, since some potential participants who have recently used drugs would choose not to participate. Even when testing is mandated (e.g. in fatal accidents), the number of toxicology screen results available for summary reporting may be substantially fewer than the number of fatalities. It is not known whether this type of unavailability biases prevalence results.

Primary Data Sources

In searching for data sources and prevalence results, we used Internet and reference database searches including terms such as methamphetamine, amphetamines, stimulants, drug use and workplace, workforce, occupational use, functional use. We accessed major federal websites dealing with workplace accident rates (e.g. Dept. of Labor Statistics and Dept. of Transportation), substance use (SAMHSA and NIDA), and specialized Drug-Free Workplace sites. We list below three major on-going data sources from which reports that include prevalence of MA in the workplace or workforce are readily available. In addition, many federal and state agencies field occasional surveys of workers or employers or analyze accident reports or drug test results; however, historically, few of these have included MA as a specific drug reported. And reports are sometimes difficult to locate. With the growing interest in the MA problem, it is possible that more data collection efforts will include specific amphetamine-type substances.

In this report, we have not included anecdotal or undocumented information, since these do not give a sound basis for prevalence estimation. However, such information may be valuable in identifying subpopulations, occupations, or venues for further study. For example, an Arizona mental health provider has recently reported that many of her patients are MA-using mine workers (personal communication). Because mines may run 24-hours a day, thus involving shift work, it is logical that MA might be a particular problem in this occupation. As additional support for this idea, there was recently a three-state (Kentucky, Virginia, West Virginia) summit conference to discuss substance abuse problems in the mining industry (MHSA, 2004). However, specific data on MA is difficult to find.

Drug-Free Workplace/Workplace Drug Testing Programs

One major source of information on workplace substance use comes from employee drug testing programs. Concern over costs brought about a new emphasis in the 1980s on worker assistance and drug-free workplace initiatives, which can include employee drug testing programs. Drug testing is

mandated through federal agencies in occupations labeled "safety sensitive" including aviation-related, utilities, transit systems, and commercial transport; and many other employers include drug testing programs in their drug-free workplace/workforce policies (Hirschberg, 1999; SAMHSA, 2004a; TATC Consulting, 2003). Testing situations include pre-employment testing of applicants, random unannounced testing of employees/contractors, post-accident testing, where there is reasonable cause for suspecting substance use, and return-to-duty testing (Clarke et al., 2004; Committee on Drug Use in the Workplace, 1994; Quest Diagnostics, 2005).

Following the 1986 federal mandate for a drug-free federal workplace, the prevalence of employee drug testing programs increased substantially. For example, in 1988 3.2% of 4,543,000 employers in a national study had a drug testing program (Hayghe et al., 1990); the highest rates of such programs were among largest employers, and in mining, communications/public utilities, and transportation sectors. Results from the National Survey on Drug Use and Health (NSDUH) indicated that in 1994, 44% of workers reported that their workplaces had some type of drug testing program, and in 1997 49% (SAMHSA, 1999). In 1999, 67% of motor carriers had drug testing programs (Scholing, 2002). In the transportation industry, minimum random drug testing rates for employees under the auspices of various federal agencies range from 25% (e.g. for the Federal Aviation or Railroad Administrations) to 50% (for US Coast Guard, Federal Transit or Motor Carrier Safety Administration) (Office of the Secretary of Transportation, 2005). In spite of the extensive coverage of drug testing programs, there has been no single reporting mechanism. In reports that we did find for specific drug testing programs, few reported prevalence of MA or related stimulants, possibly because of the historically lower rates of use of MA relative to those of alcohol, marijuana, and cocaine in most geographic areas.

One on-going summary report of drug screening results for amphetamine (including methamphetamine) comes from Quest Diagnostics, which provides the laboratory work for drug testing by many employers nationwide; there were about 7.2 million tests in 2004. The annual report covers both federally-mandated (for safety-sensitive jobs) and general workforce results from a wide range of occupations. (See summary of results below and Figures 1 and 2.)

The U.S. Department of Transportation's Federal Transit Administration (FTA) annually reports the results of drug and alcohol testing required of each recipient of FTA funds (e.g. Clarke et al., 2003, 2004). Drug test results are reported for random, post-accident, reasonable suspicion, and pre-employment screens. In 2002, 133,775 drug test specimens (employees and contractors) were available for workers from a total of 535 large employers, 36 small employers, and 237 rural employers. Amphetamine results include racemic, amphetamine, extroamphetamine, and methamphetamine. (Results for years 2001 and 2002 appear in Table 2.)

Selected results from other workplace drug testing sources are given in Table 2.

Workforce Prevalence

The NSDUH provides annual data containing both employment status (and occupation) and current (past month) use of drugs, including specifically MA for recent years (e.g. SAMHSA, 2001). Data thus allow description of MA use by the workforce. While these data do not allow specific identification of MA use while at the workplace, the duration of MA effects from a single dose and its longer-term effects suggest that use may impact the workplace even when the use itself was not

at the workplace. We have analyzed the most recent data to provide prevalence estimates for working adults (results in Figure 3 and Table 1; see also Technical Note 2). Additional items on workplace outcomes (e.g. absenteeism or turnover) are periodically included in the NSDUH. Earlier reports from these workplace data are available but do not specifically address MA (e.g. SAMHSA, 1997); analyses of more recent data are possible but were outside the scope of this report.

Other Sources

We report results (in Table 2) from several other studies of targeted occupation populations. These studies range from small research studies (e.g. 20 truckers), to larger studies of several hundred respondents, to analysis of accident toxicology screens.

Prevalence Results

There are relatively few data on MA use in the workplace or by the workforce, compared to results of more commonly used substances such as alcohol, marijuana, and cocaine. Because we found no readily available data specific to California, we have included data for the U.S., for specific locations within the U.S., and for selected international sites. We focus primarily on recent studies and summarize results in more detail from two national sources: 1) results of workplace amphetamine use from drug testing programs (nationwide); 2) self-reported recent MA use by employed people nationwide. These allow consideration of trends as well as prevalence magnitude. In addition, as context, we present a brief overview covering approximately 20 years of results that give a broad perspective of worker/workplace use of MA-related substances.

Workplace Drug Test Results (from Quest Diagnostics, 2005)

The MA positive results from workplace drug tests performed by Quest Diagnostics (2005) are shown in Figure 1 for the period 1997 to 2004. In 2004, 7.2 million test results are summarized. For the segment of the workforce with federally mandated drug testing programs (for safety-sensitive work), after a slight decrease from 1997 to 1998, we then see a gradual small increase in MA positive test results across the period (from 0.25% in 1998 to 0.31% in 2004). A more dramatic increase, doubling from 0.26% in 1997 to 0.52% in 2004, is seen for the general workforce. During the same period, positive results for all substances for the combined U.S. workforce declined slightly from 5.0% to 4.5%.

Figure 2 shows the increasing percentage of positive test results accounted for by MA. Trends across time are similar for both segments of the workforce. The federally-mandated segment experienced increases in the MA percentage of positive tests from 8.1% to 12.7%, while the general workforce segment experienced increases from 4.6% to 12%. Across this period, marijuana accounted for the largest proportion of positive drug tests (more than 50%); cocaine accounted for approximately 20% for the federally mandated segment and 14% for the general workforce segment.

Figure 1: Drug Test Results: Amphetamines Positive Rates as Percentage of All Tests (Source: Quest Diagnostics, 2001, 2005)

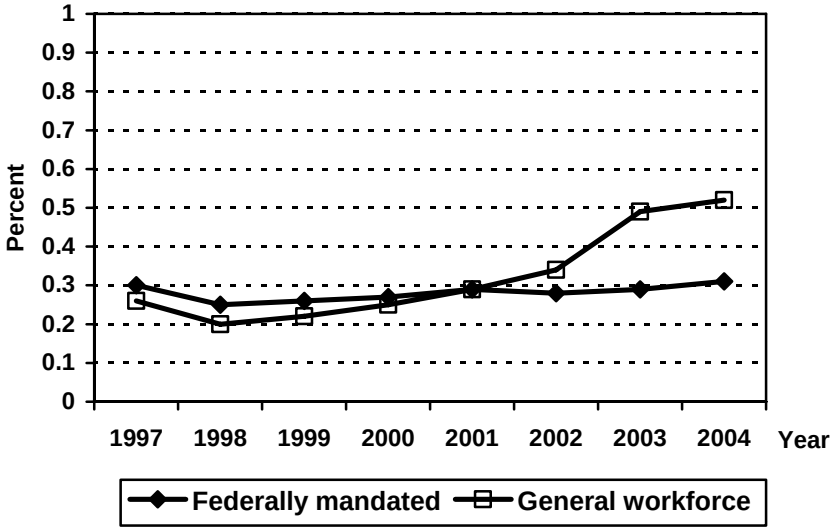
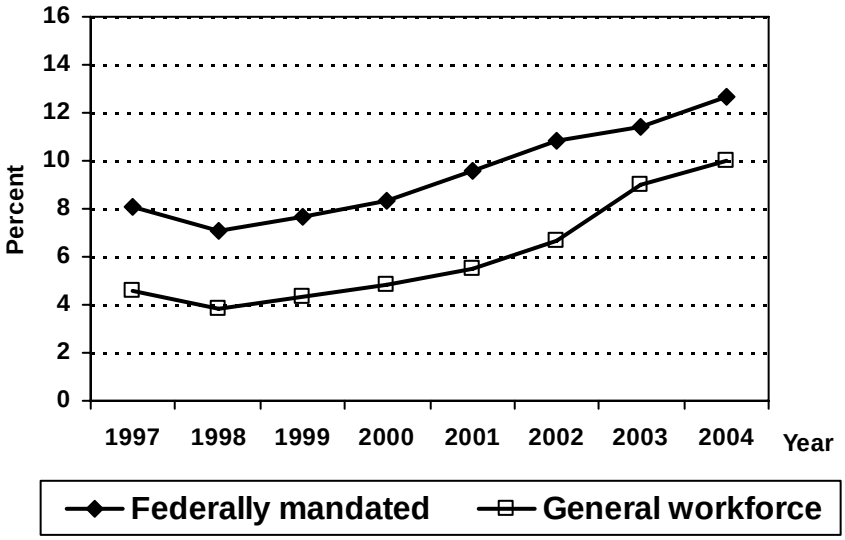


Figure 2: Drug Test Results: Amphetamines Positive Rates as Percentage of Positive Tests (Source: Quest Diagnostics, 2001, 2005)



Workforce MA use from NSDUH

Data from the NSDUH allow us to focus on substance use among employed people nationwide. For our report we have accessed the online analysis system for the NSDUH in order to assess MA use specifically for those 18 or older and employed full- or part-time (see Technical Note 2). As discussed under Types of Data above, this gives us information on workforce MA use, but not on MA use specifically in the workplace.

Figure 3 shows the trend in MA use among employed people age 18 and older from 1999-2003 and also stimulant use (including MA, but not cocaine/crack) from 1997-2003. We see an increase in past month MA use from 0.2% to nearly 0.3%. While magnitude is small, this still represents a substantial increase in workforce MA use and a non-negligible potential workplace cost. Overall stimulant use has also risen during the same period.

For 2003, current (past month) MA use was approximately 0.3% among respondents age 18 or older who were employed part- or full-time. MA use rates among employed adults were higher for men (0.4%) than for women (0.2%) and higher among those 26-34 years of age (0.6%) than for other age groups (0.5% for 18-25 years and 0.2% for 35 or older). Occupational categories with highest rates included: construction 0.8%, arts/entertainment/recreation/accommodation/food services 0.8%, other services 0.6%, wholesale trade (durable goods) 0.6%, agriculture 0.5. (See Table 1.) Considering another perspective, we find that 73.6% of current MA users 18 years of age or older were employed full or part time.

Figure 3: From NSDUH, Percentage of Those Employed Full- or Part-time Reporting Past Month Stimulant or Methamphetamine Use, 1997-2003 (Source: see Technical Note 2)

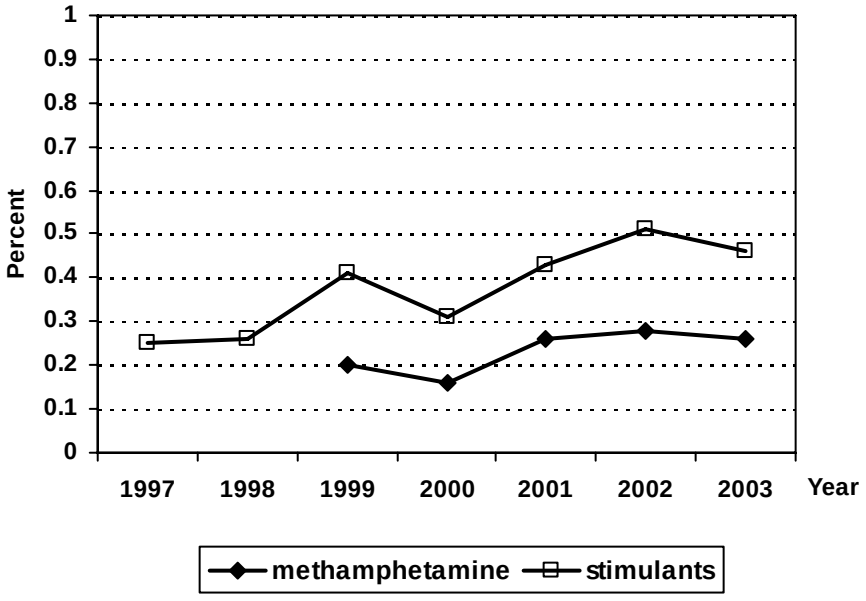


Table 1: From 2003 NSDUH, Percentage of Employed People Reporting Current (past month) MA Use by Type of Business/Industry [2]

Type of business or industry	% in type of business	% with past month MA use
Agriculture/forestry/fishing/hunting	1.7	0.5
Mining	0.4	0.2
Construction	8.3	0.8
Manufacturing, nondurable goods	4.6	0.0
Manufacturing, durable goods	7.9	0.2
Transportation/utilities	5.0	0.1
Information/communications	2.3	0.3
Wholesale trade, durable goods	1.5	0.6
Wholesale trade, nondurable goods	1.7	0.1
Retail trade	10.7	0.2
Finance/insurance/real estate/rental & leasing	6.8	0.0
Professional/scientific/management/admin.	10.1	0.4
Education/health & social services	21.0	0.1
Arts/entertainment/rec/accommodation/food services	8.2	0.8
Public administration	4.7	0.2
Other services	5.0	0.6
Total		0.3

Additional Prevalence Results

Table 2 includes results from a variety of studies over about the past 20 years. The table is organized by occupation grouping, and within that by data source year. Note that the studies differ on several dimensions (as described in an earlier section of this report) and that prevalence rates are not directly comparable but give complementary perspectives.

MA Positives from Drug Tests Among Transit Workers

In 2002, from 133,775 tests (federally mandated testing program) of employees and contractors for employers with any funding from the Federal Transit Administration, MA positive rate was 0.05% (Clarke et al., 2004). The total tests included random testing (almost 2/3 of tests), pre-employment (almost 1/3 of tests), reasonable suspicion (less than 1%), and post-accident (about 6%). The highest MA rate by testing category was for reasonable suspicion (0.66%), with other rates near the combined rate (random, 0.04%; pre-employment, 0.06%; post-accident, 0.05%). MA positive tests represented 5.3% of all drug positive tests. The MA positive rate was stable from the preceding year 2001 (0.05%) but MA represented a small percentage (2.9%) of the positive tests in 2001 (Clarke et al., 2003).

MA Use by Workers in Benton County, Arkansas

A 2004 survey of 2,934 workers from 51 employers in Benton County, Arkansas, yielded data from 648 employees (response rate 22%) (CBER, 2004). The county working age population was about 99,000. The survey included a wide range of industries, with largest numbers from finance/insurance (23% of responses), public administration (18%), manufacturing (12%), health care (7%), and retail (7%). Respondents were 49% male, 94% white, 49% high school graduates and 47% college graduates. Results from the self-report survey showed 4.3% with past use of MA; 1.4% reported using MA while at work, accounting for nearly half of reported alcohol/drug use (total for all substances 3.3%). These figures were used to project annual costs to employers' bottom lines of employed MA users for the county as a whole: $20-21 million. Costs included absenteeism, lost productivity, costs of turnover, employee theft, workers' compensation, and healthcare costs (including drug treatment), with an average cost for each employed methamphetamine user of $47,500 per year.

Other Occupations

In the general workforce, MA positive toxicology screens for fatal accidents showed rates less than 1%, lower in a 1998 study than in a 1994 study (Greenberg, 1999; Weber & Cox, 2001). This general range is similar to the national workplace and workforce studies cited above.

Self-reported MA, ATS, or stimulant use among truckers ranged from 15-28%, with the highest figure for Australia and for stimulants in general (not just methamphetamine) (Arnold, 1996; CSAP, 2002; Mabbott, 1999). Studies with voluntary drug tests produced results ranging from 2% (urine test for MA) to 30% (saliva test for stimulants) (Couper et al., 2002; Lund et al., 1989; Starmer, 1994). Note that the lowest prevalence was based on data from 1986, and more recent studies have shown higher rates. Post-accident driver fatality toxicology screens produced MA positive rates of 7% in the U.S. and 16% for ATS in Australia (Crouch et al., 1993; Drummer, 2004).

Other studies of transportation-related workers showed the following. A lower rate of 0.01% was shown for post-accident testing among railroad workers (Moody, 1990). Post-accident pilot fatality toxicology screens showed a rate of 0.65% (Canfield et al., 2000).

Work-related use of MA is very high among military pilots on deployment. For example, 65% of 664 pilots from Desert Shield/Storm reported MA use during deployment (Emonson & Vanderbeek, 1995). From the recent Iraq operation, 97% of the sample of 75 pilots reports MA use during shorter missions and 58% on longer missions (Kenagy et al., 2004).

An early study of professionals in Canada (medicine, pharmacy, law) showed that 0.3% reported using MA in the past year (Brewster, 1994). The NSDUH reports past month use of stimulants among construction workers at 0.6% (SAMHSAb, 2002). A small study of migrant construction workers in Arizona did not report worker use, but all 20 study participants reported that MA was easy to get (CSAP, 2002).

Workplace Use of MA Among MA Users *in Selected Occupations*

While previous discussion has focused on prevalence in populations that include both users and non-users of MA, some studies address work-related MA use specifically within MA-using populations. For example, a United Nations study has examined reasons for MA use among high-MA use occupations in several countries. Results showed high levels of work-related MA use (see also Table 2). In one part of this study, Liu and Hao (2004) conducted interviews with 296 ATS users in 6 provinces in China. The sample was 48% female with an average age of 26. Occupations represented included sex workers, government officials, private business owners, professional drivers, and waiters. Work-related reasons for ATS use were by 31% to "stay awake at work/study" and by 39% to "improve performance at work/study." Ali et al. (2005) combined data from ATS-using workers from the several sites and found high rates reporting ATS use to improve concentration: 76% of professional drivers (of total n=256 combined from China, Nigeria, and Thailand); 80% of sex workers (of total n=242 from China, Philippines, and Thailand; and 78% of factory workers (of total n=196 from Nigeria and Philippines). Reported ATS use to stay awake at work was 82%, 86%, and 69% for drivers, sex workers, and factory workers, respectively; and ATS use to improve performance was reported by 82%, 85%, and 67% for the three worker groups, respectively.

Brecht et al. (2004) found that 15% of a sample treated for MA abuse reported initiating MA use "to work more," 44% "to get energy," and 34% "to stay awake."

Preliminary Estimate of Potential Costs to California Businesses

On-going data sources have not been found that report California-specific MA workplace prevalence. However, applying reported national MA prevalence estimates (of 0.3% and 0.5%), we can obtain a lower limit to the number of MA-using California workers ranging from 44,000 to 73,500 depending on data source. (See Technical Note 3 for more detail on calculations.) But because drug use indicators typically show California to have higher rates of MA use than the national average, we have used additional information from the Quest Diagnostics study (2005) to infer a more realistic but still conservative MA workplace prevalence rate estimate of at least 1.0%; application of this prevalence rate suggests that there may be closer to 147,000 workers with workplace MA use in California. While costs have not yet been specialized to the California workplace, cost estimates from the CBER (2004) study applied to the 1.0% prevalence rate gives a preliminary estimate of costs of around $6.9 billion. Because this is a rough estimate, we urge caution in interpreting its exact magnitude; however, it does suggest a potentially very large impact of MA workplace/workforce use.

Table 2: Prevalence of Work-related Use of MA (or other Stimulant) from Selected Studies

Occupation	Data from	Reference	Data collection method	Sample size	Location	Drug	Metric	Rate
Studies Producing Prevalence Rates (from Samples Including Both Users and Non-Users)								
General	2004	CBER, 2004	Self-report	648 employees	AK Benton Co.	MA	Ever used at work	1.4%
General	1998	Weber & Cox, 2001	Workplace fatal injury toxicology screen	3,055 tox screens	U.S.	MA	+	.26%
General	1993-94	Greenberg, 1999	Workplace fatal injury toxicology screen	3,141 tox screens	U.S.	MA	+	.96%
Trucking	2000	CSAP, 2002	Self-report	20	AZ truck stop	MA	Ever used	15%
Trucking	1998-99	Couper et al., 2002	Urine (voluntary)	822	OR, WA	MA	+	1.7%
Trucking	1997	Mabbott & Hartley, 1999	Self-report	286	Australia truck stop	Stimulants (excl. caffeine)	Ever used while driving	28%
Trucking	1995	Arnold et al., 1996	Self-report	638	Australia	Stimulant	Ever used while driving	16%
Trucking	Early 1990s	Starmer et al., 1994	Saliva	318	Australia	Stimulant (excl. caffeine)	+	30%
Trucking	1990-99	Drummer et al., 2004	post-accident, driver fatality toxicology screen	139	Australia	ATS	+	16%
Trucking	1987-88	Crouch et al., 1993	Post-accident, driver fatality tox screen	168	US (8 states, CA, CO, GA, MD, NJ, NC, TN, WI)	Amphetamines	+	7%
Trucking	1986	Lund et al., 1989	Urine test (voluntary)	317	TN weigh station	ATS-medically unexplainable	+	10%
Trucking	1986	Lund et al., 1989	Urine test (voluntary)	317	TN weigh station	MA	+	2%
Railroad	1987-88	Moody et al., 1990	Urine test (post-accident, mandatory)	1398	US nationwide	MA	+	.01%
Transit	2002	Clarke et al. 2004	Urine test (mandatory program)	133,775	US nationwide	MA	+	.05%
Transit	2001	Clarke et al. 2003	Urine test (mandatory program)	131,252	US nationwide	MA	+	.05%
Pilots (civil)	1994-98	Canfield et al., 2000	Tox screens from fatal accidents (FAA required)	1683	US nationwide	MA	+	.65%
Construction	2000-01	SAMHSA, 2002	Self-report	Projected to US population	US	Stimulants	Past month use	0.6%

Occupation	Data from	Reference	Data collection method	Sample size	Location	Drug	Metric	Rate
Migrant construction	2000	CSAP, 2002	Self-report	20	AZ	MA	"MA easy to get" (no report on actual use)	100%
Professional (medicine, pharmacy, law)	1992-93	Brewster, 1994	Self-report	Approx. 1250	Canada	MA	Used in past yr	0.3%
Military-pilots	1991	Emonson & Vanderbeek 1995	Self-report	664 pilots	US (Desert Shield/Desert Storm)	MA	Used during deployment	65%
Military-pilots	2002	Kenagy et al., 2004	Self-report	75 pilots in 94 sorties	US (Operation Iraqi Freedom)	MA	Used during shorter missions Used during longer missions	97% 58%
Studies on workplace use by MA users								
General	1999-2000	Brecht et al., 2004	Self-report	352 MA treated users	CA	MA	"*Initiated* MA use to work more, get energy, stay awake"	15%, 44%, 34%, respectively
General	2000-2001	Liu & Hao (2004)	Self-report	296 ATS users	China	ATS	"Used at work (sometimes/often/always)"	27%
Drivers (professional)	2000-2002	Ali et al., (2005)	Self-report	256 ATS-user drivers	China, Nigeria, Thailand	ATS	"Used to improve concentration, stay awake, improve performance"	76%, 82%, 82%, respectively
Sex workers	2000-2002	Ali et al., (2005)	Self-Report	242 ATS-user sex workers	China, Philippines, Thailand	ATS	"Used to improve concentration, stay awake, improve performance"	80%, 86%, 85%, resp.
Factory workers	2000-2002	Ali et al., (2005)	Self-Report	196 ATS-user factory workers	Nigeria, Philippines	ATS	"Used to improve concentration, stay awake, improve performance"	78%, 69%, 67%, resp.

Summary and Recommendations

For this report we have examined a variety of available data sources and study reports for determining MA workplace prevalence. While data allow assessment of general trends, less detail is available specifically for California and for most occupations. However, the available data do suggest increasing national trends of workplace MA use and potential costs. These increases substantiate a need for continuing attention to workplace substance-related programs to assure their relevance to MA users and the possible expansion of such programs in high risk occupations.

- National indicators of workplace MA use suggest an increase in both self-reported use by employed persons and positive results from drug testing programs across all occupations nationwide. Increases vary across data sources, but may have doubled from 1997 to 2004 in the general workforce.
- National MA prevalence rates from two major national sources are small, typically less than 1% of all worker self-reports or tests.
- MA represents a growing proportion of positive test results.
- Rates are lower among workers tested as part of federally-mandated programs in safety-sensitive workplaces than in the general workforce. Rates appear highest (at the national average or higher) among occupations including construction, services, wholesale trade, and agriculture.
- While MA workplace/workforce prevalence rates are low in comparison to other substances such as alcohol, marijuana, cocaine, these small rates still represent considerable cost to business. Costs per MA-using worker were estimated at $47,500 in an Arkansas study. A preliminary consideration of possible workplace MA use cost to California businesses suggested costs of at least $6.9 billion in a single year; but it is important to note that this is a rough approximation, using some data from the Arkansas study that was not specific to California.
- At least three nationwide on-going databases were identified, from which readily available reports include workplace or workforce MA use. But these available reports do not contain detailed California-specific results.
- Relatively few other studies or databases have been found reporting rates of MA, ATS, or stimulant use. Historically, because of low MA prevalence, it has often not been reported specifically. With the growing concern over MA use, more reports may become available with relevant detail.
- Care must taken when interpreting workplace prevalence results, since data sources differ along many dimensions and may not be directly comparable.

Further study could support the following:

- Identify data sources which report workplace MA use specifically for California workers.
- Estimate potential costs of MA workplace use in California using California-specific data on absenteeism, turnover, productivity, wages, workers' compensation claims, accident rates, health care costs.
- Identify additional data sources for specific occupations. Additional funding could allow contact or website access of occupational organizations and federal agencies with

oversight of a broader set of occupations to determine whether they maintain databases and/or produce reports that include workplace MA use.

- Additional analysis of NSDUH data: to assess workplace outcomes for MA users (from most recent survey that contains relevant data); to assess the possibility of estimating CA workforce MA use by combining 2-3 years of recent NSDUH data, and carry out analyses if possible.
- Field a survey of CA employers to assess prevalence of workplace drug testing programs, summary results of MA positives from those programs.

Technical Notes

1. We will use the abbreviation MA to indicate methamphetamine or a combination of methamphetamine/amphetamine. Some studies report data on amphetamines in general, including methamphetamine as well as other amphetamines. Others report methamphetamine alone. Still others use a slightly broader reference to stimulants (not including cocaine/crack/caffeine) or to "amphetamine-type substances" (ATS). We will distinguish the general class of stimulants as data allow; however, when not distinguishable, we will use the term MA. Note that generally methamphetamine comprises the vast majority of substance use within the more general stimulant category; e.g. for 2002 nationwide, the distribution of relevant treatment admissions breaks down to 90% methamphetamine, 9% amphetamines, and less than 1% other stimulants (SAMHSA, 2004c), and for California (from CADDS) 98%, <2%, <1% methamphetamine/amphetamine/other stimulant, respectively.

2. Online analysis of 2003 NSDUH, using variables WRKIDST2 (type of business or industry) and MTHMON (methamphetamines – past month use). Accessed 6/2005 from http://webapp.icpsr.umich.edu/cocoon/ICPSR-DAS/04138.xml

3. As a lower limit to cost of MA use to employers in California, we calculated two versions based on reported prevalence, one using the national workforce MA prevalence rate from the NSDUH and the second using the national MA positive drug test results from Quest Diagnostics. We used 2000 Census figures which estimated that 14.7 million Californians age 16 and older were employed (from QuickFacts at http://factfinder.census.gov/). If we multiply that figure by the NSDUH 2003 past month MA rate of approximately 0.3%, we obtain a total of about 44,000 workers potentially impacted by MA use. Using the 0.5% general workforce figure from Quest Diagnostics drug tests, we obtain a total of about 73,500. Multiplying by the $47,500 cost per worker obtained for the Benton County, Arkansas, study (CBER, 2004), we get a lower limit range of $2.1 billion to $3.5 billion for cost impact of MA use to California business in one year.

This is an approximation, with potential inaccuracies in costs or prevalence. We adopted a cost per worker estimated by the Arkansas study (CBER, 2004), which used cost categories from national studies and national or local estimates for those categories increased for inflation. Costs included absenteeism, lost productivity, costs of turnover, employee theft, workers' compensation, and healthcare (including drug treatment). Specific costs may be different for California workers, and could thus lead to a different per worker estimate. In terms of prevalence, we feel that related information, while not actually giving documented figures, strongly suggest that the actual numbers of MA-impacted workers in California could be substantially higher for three primary reasons. The worker census figure is from year 2000, and the population has been increasing in California (thus there are now more workers). MA use may be still increasing in California, such that current rates would be higher than the 2003 and 2004 prevalence data used. And, having a potentially larger impact on the estimated MA prevalence, California has historically had considerably higher rates of MA use than the national as a whole. Recent NSDUH figures for MA are not readily available for California. But according to a Quest Diagnostics zip code map, most areas of California are in the higher rate categories of MA positive test results, 0.6-1.01% and 1.01 to 2.63% with major metropolitan areas in the highest category. Therefore, as a more realistic but still conservative estimate of California workplace cost, we recalculated using a rate of 1.0%. This calculation produced a possible 147,000 workers using MA and possible costs of $6.9 billion. This is probably

still an underestimate. An exact prevalence figure could not be exactly ascertained from the published Quest Diagnostics map and the company did not return our phone calls requesting detailed figures for California. The Arkansas report suggested an even higher workplace MA prevalence rate for that state, at least 1.4% and the Quest Diagnostics zip code map showed a smaller proportion of the areas in the high rate category than for California.

References

Ali, R., Marsden, J., Pointer, S., & McIver, C. (2005) *Methamphetamine: Cultural & Social Impact in South Eastern Asia*. South Australia: Drug and Alcohol Services Council. Unpublished presentation.

Arnold, P., Hartley, L., Penna, F., Hochstadt, D., Corry, A. & Feyer, A. (1996) *Fatigue in the Western Australian transport industry: the driver's perspective,* Report Number 188. Murdoch, Perth: Institute for Research in Safety & Transport, Murdoch University, Western Australia.

Brecht, M.-L. & Greenwell, L. (2004) *Admissions to Treatment for Methamphetamine Abuse, California 1992-2002 (CADDS): Trends AND Predictors of Treatment completion and Retention*. Report to the California Office of Alcohol and Drug Programs. Los Angeles: UCLA Integrated Substance Abuse Programs.

Brecht, M.-L., O'Brien, A., von Mayrhauser, C., & Anglin, M. D. (2004) Methamphetamine use behaviors and gender differences. *Addictive Behaviors, 29*(1), 89-106.

Brewster, J. (1994) *Drug Use Among Canadian Professionals: Executive Summary of Final Report*. Ottowa: Minister of National Health and Welfare.

(CBER) Center for Business and Economic Research, University of Arkansas Sam M. Walton College of Business (2004) *Final Report: The Economic Impact of Methamphetamine Use in Benton County, Arkansas.* Fayetteville: University of Arkansas Sam M. Walton College of Business Center for Business and Economic Research.

Caldwell, J. A. (2001) Efficacy of stimulants for fatigue management: the effects of Provigil and Dexedrine on sleep-deprived aviators. *Transportation Research Part F. 4*, 19-37.

Caldwell, J.A., Caldwell, J.L., Crowley, J., & Jones, H. (1995) Sustaining helicopter pilot performance with Dexedrine during periods of sleep deprivation. *Aviation, Space, and Environmental Medicine. 66*(10), 930-937.

Canfield, D., Hordinsky, J., Millett, D., Endecott, B., & Smith, D. (2000) *Prevalence of Drugs and Alcohol in Fatal Civil Aviation Accidents Between 1994 and 1998.* Washington, DC: Office of Aviation Medicine.

Clarke, R., Gaumer, R., Redington, M., & Rutyna, E. (2004) *Drug and Alcohol testing Results 2002 Annual Report.* Report no. FTA-MA-26-5017-05-01. Washington, DC: U.S. Dept. of Transportation, Federal Transit Administration.

Clarke, R., Gaumer, R., Redington, M., & Rutyna, E. (2003) *Drug and Alcohol testing Results 2001 Annual Report.* Report no. FTA-MA-26-5017-05-01. Washington, DC: U.S. Dept. of Transportation, Federal Transit Administration.

Committee on Drug Use in the Workplace, National Research Council/Institute of Medicine. Normand, J., Lempert, R., & O'Brien, C. (editors). (1994) *Under the Influence?: Drugs and the American Work Force.* Washington, DC: National Academies Press.

Couper, F., Pemberton, M., Jarvis, A., Hughes, M. & Logan, B. (2002) Prevalence of drug use in commercial tractor-trailer drivers. *Journal of Forensic Sciences. 47*(3), 562-567.

Crouch, D., Birky, M., Gust, S., Rollins, D., Walsh, J. & Moulden, J. (1993) The prevalence of drugs and alcohol in fatally injured truck drivers. *Journal of Forensic Science*. 38(6), 1342-1353.

(CSAP) Center for Substance Abuse Prevention (2002) *Communication Strategy Guide: A Look at Methamphetamine Use Among Three Populations*. Rockville, MD: CSAP, Dept. of Health and Human Services, Substance Abuse and Mental Health Services Administration.

(CSAP) Center for Substance Abuse Prevention (1998) Fact Sheet: Injury/Disability/Workers' Compensation. Rockville, MD: CSAP, Dept. of Health and Human Services, Substance Abuse and Mental Health Services Administration. (Accessed 7/7/2005) Available at http://workplace.samhsa.gov/SubstanceAbuse/SAInjuriesAccidents/Injury.pdf#search='injury/disability/workers'%20compensation'

Drummer, O., Gerostamoulos, J., Batziris, H., Chu, M., Caplehorn, J., Robertson, M., & Swann, P. (2004) The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. *Accident Analysis and Prevention, 36*, 239-248.

Emonson, D. & Vanderbeek, R. (1995) The use of amphetamines in U.S. Air Force tactical operations during Desert Shield and Storm. *Aviation, Space and Environmental Medicine, 66*(3), 260-263.

Greenberg, M., Hamilton, R., & Toscano, G. (1999) *Analysis of Toxicology Reports from the 1993-94 Census of Fatal Occupational Injuries.* U.S. Bureau of Labor Statistics Compensation and Working Conditions. Fall 1999. (Accessed 7/7/2005) Available at http://www.bls.gov/opub/cwc/archive/fall1999brief1.pdf

Hart, C., Ward, A., Haney, M., Nasser, J., Foltin, R. (2003) Methamphetamine attenuates disruptions in performance and mood during simulated night-shift work. *Psychopharmacology, 169*(1), 42-51.

Hayghe, H. (1990) Survey of employer anti-drug programs. In Gust, S. et al., *Drug in the Workplace: Research and Evaluation Data, Volume 2*. Washington DC: DHHS.

Hirschberg, L. (1999) *The EAP Handboo*k. Pittsburgh, PA: The Consad Corp.

Hunt, D., Kuck, S., & Truitt, L. (2005) *Methamphetamine Use: Lessons Learned*. Report for Dept. of Justice Contract No. 99-C-008. Cambridge, MA: Abt.

Kenagy, D., Bird, C., Webber, C., & Fischer, J. (2004) Dextroamphetamine use during B-2 combat missions. *Aviation and Space Environmental Medicine, 75*(5), 381-386.

Kyle, A. & Hansell, B. (2005) *The Meth Epidemic in America*. National Association of Counties. (Accessed 7/7/2005). Available at http://www.naco.org/Content/ContentGroups/Publications1/Press_Releases/Documents/NACo-MethSurvey.pdf

Liu, T., Hao, W. (2004) *WHO Multi-site Project on Amphetamine-type Stimulants Evaluation: Report from China*. Unpublished report.

Lloyd, J. (1998) How drug testing has changed the job market. *The Christian Science Monitor*. 11/20/1998.

Logan, B. (2002) Methamphetamine—Effects on human performance and behavior. *Forensic Science Review. 14*(1/2), 133-151.

London, E., Simon, S., Berman, S., Mandelkern, M., Lichtman, A., Bramen, J., Shinn, A., Miotto, K., Learn, J., Dong, Y., Matochik, J., Kurian, V., Newton, T., Woods, R., Rawson, R., & Ling, W. (2004). Mood disturbances and regional metabolic abnormalities in recently abstinent methamphetamine users. *Archives of General Psychiatry,* 6*1*(1), 73-84.

Lund, A., Preusser, D., Blomberg, R., & Williams, A. (1989) Drug use by tractor-trailer drivers. In Gust, S. et al. *Drugs in the Workplace: Research and Evaluation Data*. Washington DC: DHHS.

Mabbott, N. & Hartley, L. (1999) Patterns of stimulant drug use on Western Australian heavy transport routes. *Transportation Research Part F. 2*, 115-130.

Moody, D., Crouch, D., Andrenyak, D., Smith, R. et al. (1990) Mandatory post-accident drug and alcohol testing for the federal railroad administration: a comparison of results for two years. In Gust, S. et al., *Drug in the Workplace: Research and Evaluation Data, Volume 2*. Washington DC: DHHS.

(MSHA) Mine Safety and Health Administration (2004) Substance Abuse Summit 2004, Keeping America's Mines Drug- and Alcohol-Free. U.S. Department of Labor Mine Safety and Health Administration. (Accessed 7/7/2005) Available at http://www.msha.gov/FocusOn/DASummit/DrugSummit2004.asp

(NDIC) National Drug Intelligence Center (2005) *National Drug Threat Assessment*. Washington, D.C.: U. S. Department of Justice.

(NSAWC) Naval Strike and Air Warfare Center. (2004) *Performance Maintenance During Continuous Flight Operations: A Guide for Flight Surgeons*. NAVMED P-6410. (Accessed 7/7/2005) Available at http://www.vnh.org/PerformMaint/

(NIDA) National Institute on Drug Abuse (2005) *NIDA InfoFacts: Methamphetamine*. (Accessed 7/7/2005) Available at http://www.nida.nih.gov/pdf/infofacts/Methamphetamine05.pdf

(NIDA) National Institute on Drug Abuse (2002) *NIDA Research Report—Methamphetamine Abuse and Addiction*. NIH Publication No. 02-4210. (accessed 7/7/2005) Available at http://www.drugabuse.gov/ResearchReports/methamph/methamph.html

Office of the Secretary of Transportation (2005) *Current Random Testing Rates*. Accessed (7/7/2005) Available at http://www.dot.gov/ost/dapc/rates.html?prog

(ONDCP) Office of National Drug Control Policy (2001). *The Economic Costs of Drug Abuse in the United States, 1992-1998*. Washington, DC: Executive Office of the President (Publication No. NCJ-190636).

Quest Diagnostics (2005) *Drug Testing Index*. Lyndhurst, NJ: Quest Diagnostics.

Quest Diagnostics (2001) Drug Testing Index. Lyndhurst, NJ: Quest Diagnostics.

Richter, L., & Johnson, P.B. (2001). Current methods of assessing substance use: A review of strengths, problems and developments. *Journal of Drug Issues, 31*(4), 809-830.

(SAMHSA) Substance Abuse and Mental Health Services Administration. (2004a) *Mandatory Guidelines for Federal Workplace Drug Testing Programs.* (Accessed 7/7/2005) Available at http://dwp.samhsa.gov/FedPgms/Pages/HHS_Mand_Guid_Effective_Nov_04.aspx

(SAMHSA) Substance Abuse and Mental Health Services Administration, Office of Applied Studies (2004b) *The DASIS Report: Primary Methamphetamine/Amphetamine Treatment Admissions, 1992-2002*. (Accessed 7/7/2005) Available at http://www.oas.samhsa.gov/2k4/methTX/methTX.htm

(SAMHSA) Substance Abuse and Mental Health Services Administration. (2004c) *Treatment Episode Data Set (TEDS): 1992-2002. National Admissions to Substance Abuse Treatment Services*, DASIS Series: S-23, DHHS Publication No. (SMA) 04-3965, Rockville, MD.

(SAMHSA) Substance Abuse and Mental Health Services Administration (2002a). *The NHSDA Report: Substance Use, Dependence or Abuse Among Full-Time Workers.* (Accessed 7/7/2005) Available at http://www.oas.samhsa.gov/2k2/workers/workers.pdf

(SAMHSA) Substance Abuse and Mental Health Services Administration (2002b). *Illicit Drug Use Among Construction Workers (2000 and 2001).* (Accessed 7/7/2005) Available at http://oas.samhsa.gov/construction.htm

(SAMHSA) Substance Abuse and Mental Health Services Administration (2001). *Summary of Findings from the 2000 National Household Survey on Drug Abuse* (National Household Survey on Drug Abuse Series: H-13, DHHS Publication No. SMA 01-3549). Rockville MD: SAMHSA

(SAMHSA) Substance Abuse and Mental Health Services Administration (1997) *An Analysis of Worker Drug Use and Workplace Policies and Programs*. http://www.oas.samhsa.gov/WKPLACE/httoc.htm

(SAMHSA) Substance Abuse and Mental Health Services Administration. (1989) *Model Plan for a Federal Drug-Free Workplace Program.* (Accessed 7/7/2005) Available at http://dwp.samhsa.gov/FedPgms/Pages/Model_Plan.aspx

Schooling, W. (2002) How effective are the drug & alcohol rules? *Ten Four Magazine*. (Accessed 7/7/2005) Available at http://www.tenfourmagazine.com/waynes/2002/10.html

Simon, S., Berman, S., Dacey, J., Ling, W., Rawson, R., & London, E. (2004). Logical reasoning in methamphetamine abusers during the first month of abstinence. Presented at *College on Problems of Drug Dependence*, June.

Starmer, G., Mascord, D., Tattam, B., & Zeleny. R. (1994) *Analysis for Drugs in Saliva*, Report No. CR141. Canberra: Federal Office of Road Safety.

Tamura, M. (1989) Japan: stimulant epidemics past and present. *United Nations Office on Drugs and Crime Bulletin on Narcotics 1989*, issue 1. (Accessed 7/7/2005) Available at http://www.unodc.org/unodc/en/bulletin/bulletin_1989-01-01_1_page007.html

TATC Consulting (2003) *Briefing Book for the Drug-Free Workforce Conference (July 10-11, 2003).* Prepared for the U.S. Department of Labor. Washington, DC: TATC Consulting.

Weber, W. & Cox, C. (2001) Work-related fatal injuries in 1998. *Bureau of Labor Statistics Compensation and Working Conditions, Spring.* (Accessed 7/7/2005) Available at http://www.bls.gov/opub/cwc/archive/spring2001art3.pdf

Wickizer, T., Kpojar, B., Franklin, G., & Joesch, J. (2004) Do drug-free workplace programs prevent occupational injuries? Evidence from Washington state. *Health Services Research, 39*(1), 91-110.

Zhang, Z. for National Institute of Justice. (2003) Drug and Alcohol Use and Related Matters Among Arrestees 2003. Washington, DC: National Institute of Justice. (Accessed 7/7/2005) Available at http://www.ojp.usdoj.gov/nij/adam/ADAM2003.pdf

Zhang, Z., Huang, L., & Brittingham, A. (1999). *Worker Drug Use and Workplace Policies and Programs: Results from the 1994 and 1997 National Household Survey on Drug Abuse*. Substance Abuse and Mental Health Services Administration Analytic Series Report A-11. (Accessed 7/7/2005) Available at http://www.oas.samhsa.gov/NHSDA/A-11/TOC.htm